xmmextractor

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Abstract

xmmextractor is a metatask for general processing of all the XMM-Newton data corresponding to one observation, but in particular, for the extraction of scientific reduced data related to one point source. A word of caution here: at this stage **xmmextractor** is an experimental task, which has not been neither optimized nor thoroughfully tested in its extremely wide parameter space.

1 Instruments/Modes

Instrument	Mode
EPIC PN	IMAGING, TIMING, BURST
EPIC MOS	IMAGING, REDUCED IMAGING, TIMING, COMPRESSED TIMING
RGS	SPECTROSCOPY
OM	IMAGING

2 Use

pipeline processing	no
interactive analysis	yes

3 Description

The SAS package **xmmextractor** can be used to process data from EPIC MOS and PN, RGS and OM instruments, starting at the ODF level. **xmmextractor** task only needs the environmental SAS_ODF pointing to the location of the ODF data to run.

xmmextractor has only one input parameter `paramfile`, this parameter is an XML file produce by **odfParamCreator** task, for more information about the XML structure and content, please read the **odfParamCreator** documentation. Nevertheless, and the end of this chapter we have added the explanation of the XML tag **analisisoption** for completion. If the user leaves this parameter empty, the

xmmextractor task runs automatically the **odfParamCreator** generating the XML file.

Firt of all, **xmmextractor** runs **cifbuild** and **odfingest**, setting the corresponding environmental variables SAS_CCF and SAS_ODF to the right values. **xmmextractor** comprises calls to several metatasks, **epproc**, **emproc**, **rgsproc**, **omichain**, thus performing the whole data reduction corresponding to any combination of chosen data within an observation with the final products of all those metatasks. In addition it allows the user to perform in a semi-automatic way the usual analysis corresponding to a point source by the EPIC data, starting from the source coordinates, and including source extraction radius, background region, and eventual measures to avoid pile-up. Interactivity for optimization of all these parameters can be enabled, which allows the user to select a source and a background regions. For GTI filtering, there are two alternative ways for optimization, the default choice is the use of **eregionanalyse**, which is applied also automatically in the non interactive case. The alternative to it is an optimization based on maximization of the signal to noise ("MaxSNR") described in the Appendix A of [Pic2004][1]. In this case the user has to define graphically source and background regions. The final products are spectra with corresponding response matrices and exposure corrected light curves. General source detection can be also enabled for the EPIC data, including control of the main parameters corresponding to **edetect_chain**. If processing of RGS data is enabled, the whole of **rgsproc** runs up with eventually defined source coordinates, otherwise the proposal coordinates will be used. For OM analysis, the dedicated chain **omichain** is ran.

For EPIC spectral and light curve analysis, the standard filtering is applied to the calibrated event list. For PN analysis, the following filter parameters are applied: PATTERN ≤ 4, FLAG == 0 and #XMMEA_EP. For MOS analysis, the following filter parameters are applied: PATTERN ≤ 12 (Imaging) and PATTERN == 0 (Timing) , FLAG == 0 and #XMMEA_EM.

xmmextractor creates the following directory structure:

```
\[workingDirectory]
  \pn::       epproc products
  \mos::      emproc products
  \rgs::      rgsproc and rgslccorr products
  \om::       omchain products
  \gti::      GTI filtering products
  \epatplot:: epatplot products
  \images::   edetectchain products
  \spectra::  eregionanalyse and especget products
  \lcurve::   epiclccorr products
  \results::  output log files
```

One of the most important parameter in the XML file is: **analisisoption**. There are 6 different analysis options:

1. `0:all` : all the exposures corresponding to the chosen observation are reduced to calibrated event lists, unless disabled via the corresponding parameter (`PN`, `MOS`, `RGS`, `OM`, all set to "yes" by default). If the calibration index file or SAS summary file are missing from the working directory they are created in a previous step. In addition, source spectrum, light curve and response matrices are extracted using the user defined coordinates as input for the center of the source region (or, if not specified by the user, the coordinates are taken from the SAS summary file). The EPIC data is then searched for source detections, via **edetect_chain**. By default, for the EPIC data, if more than one exposure is present, these actions are taken over the event list corresponding to the longest observation. In the case

[1] Piconcelli, E., et al., 2004, MNRAS, 351, 161

of EPIC MOS in Timing, the timing observation is analysed, leaving out the imaging part of the exposure corresponding to the outer CCDs. Also, RGS spectra are derived together with response matrices, fluxed spectra and exposure corrected and background subtracted light curves. In the case of OM data, all the products from running **omchain** are generated, using the default parameters.

2. **1:events**: this option runs **epproc**, **emproc**, **rgsproc**, **omichain**, all with default parameters,
3. **2:gti**: starting from the calibrated EPIC event lists, this option optimizes signal to noise ratio through definition of GTIs for graphically chosen source and background area,
4. **3:edetectchain**: starting from EPIC event lists, source detection is performed with **edetect_chain**
5. **4:epic_spectra**: either using the GTIs produced by the "MaxSNR" method, or by running (default) **eregionanalyse**, source and background spectra + corresponding response matrices are derived,
6. **5:epic_lightcurve**: either using the GTIs produced by the "MaxSNR" method, or by running (default) **eregionanalyse**, exposure corrected and background subtracted light curves are produced via **epiclccorr**,
7. **6:rgs_lightcurve**: starting from the calibrated RGS event lists, this option creates RGS background substracted lightcurves running **rgslccorr**.

xmmextractor produces as output a new XML file with the same structure as the input parameter file but with additional information gathered during the execution of the task. This new information is mainly the expressions used for spectral and light curve production. The output parameter file can be used as input to the **xmmextractor** task.

4 Parameters

This section documents the parameters recognized by this task (if any).

Parameter	Mand	Type	Default	Constraints
paramfile	yes	string		

Input parameter file obtained from **odfParamCreator** task

outputfile	yes	string		

Output parameter file.

5 Errors

This section documents warnings and errors generated by this task (if any). Note that warnings and errors can also be generated in the SAS infrastructure libraries, in which case they would not be documented here. Refer to the index of all errors and warnings available in the HTML version of the SAS documentation.

Computing GTI *(error)*
Error occurred while running GTI subroutine

Running edetect_chain *(error)*
Error occurred while runnig edectectchain subroutine

Producing Spectrum *(error)*
Error occurred while runnig epic spectrum subroutine

Producing Light Curves *(error)*
Error occurred while runnig epic light curve subroutine

Producing epatplot *(error)*
Error occurred while runnig epatplot subroutine

Running PG_gti_filter *(error)*
Error occurred while runnig MaxSNR subroutine

analysis option not found *(error)*
Wrong analysis option

source name not found *(error)*
Source name parameter not found

obsid not found *(error)*
Observation ID not found

6 Input Files

1.

7 Output Files

1.

8 Algorithm

9 Comments

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References